The NEAR Solar Conjunction Experiment

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The Near Earth Asteroid Spacecraft (NEAR), the first of NASA’s
Discovery missions was occulted by the disk of the Sun on 18 February
1997. From 7 February 1997 through 3 March 1997, the NEAR
telecommunications
system was used to carry out a combination of engineering and science
measurements as the line of sight of the spacecraft carrier
signal approached the solar disk. At a variety of projected radial
distances within -20 solar radii during ingress and egress, experiments
were
run using the NEAR X-band carrier in both one-way and two-way coherent
transmission mode and with multiple Deep Space Network (DSN) 34 m
antennas. Phase and amplitude measurements have been made
that will permit construction of the coronal electron density
and electron density variations (turbulence) along the projected
spacecraft trajectory across the sky.

Engineering measurements relevant to the real-time downlink for a Solar
Probe operating at X-band have also been obtained. Context has been provided by simultaneous measurements using the LASCO and UVCS instruments on SOHO as well as with the X-ray imaging system on YOHKOH. The experiment has also measured the time delay in the communication link due to the gravitational field of the Sun by monitoring the trajectory of NEAR via Doppler and ranging measurements allowing a measurement of general relativistic effects. A description of the measurements made, along with some preliminary results and their implications both for our understanding of the solar corona and for a Solar Probe mission will be discussed.